

de Quatrefages's work on the pigmies, the present instalment dealing with the Asiatic pigmies or negritos, and the negrillos or African pigmies. The general conclusion to which the writer comes is that modern science has erred in rejecting all that has been written on this subject by the ancients, for in the midst of many exaggerations and fables there were many facts. He finds it impossible, in the present state of our knowledge, to offer a satisfactory solution of one of the most curious points connected with the geographical distribution of the human race, viz. the narrow resemblance between the Asiatic negritos and the African negrillos, separated as they are by a vast space and by numerous and different races. Are these affinities the result of a common origin? A paper containing a translation of a Dutch account of Malacca, written in 1726, follows this, and is itself succeeded by a long one by Mr. Maxwell, of the Straits Settlement Civil Service, on the laws and customs of the Malays with reference to the tenure of land. The Rev. J. Tenison-Woods prints two lectures on the stream-tin deposits of the protected State of Perak in the Malay peninsula, and the volume concludes with two accounts of travel, one through the State of Remban in the peninsula, the other along the Tawaran and Putalan rivers, which are said to rise in the great mountain Kina Balu, and flow through North Borneo. We observe, also, the prospectus of a very necessary work—an English-Malay dictionary, which, it is suggested, should be translated from Mr. Klinkert's Dutch-Malay dictionary.

Journal de Physique, vol. iv. January.—J. R. Benoit, construction of standard prototypes of the legal ohm. M. Benoit, who was associated with MM. Mascart and de Neville in the official French researches at the Collège de France, has, at the request of the Minister of Posts and Telegraphs, prepared standards in mercury to represent the legal ohm. This paper gives an account of the methods of calibrating and preparing the tubes for four exact standards. It remains to be seen whether these will prove as permanent as standards constructed in platinum-silver or iridio-platinum alloy.—H. Pellat, on the cause of electrification of storm clouds. Discusses the observations of atmospheric potential at different levels, and concludes that the negative charge of the soil surface is explicable on the hypothesis that it is continually renewed by the falling of negatively charged rain.—E. Bouty, on latent heats of vaporisation. Deduces the approximate law that the latent molecular heats of bodies measured at their normal boiling temperatures are proportional to the squares of these temperatures; tabular evidence is given in support.—E. Bouty, on the specific heat of saturated vapours. Gives a new formula.—Em. Paquet, determination of the ratio of the two specific heats of gases. Describes a modification of Cazin's method, in which the desired change of pressure is brought about by a column of mercury, as in Geissler's mercurial pumps. The deduced value for air is 1.4038.—J. Macé de Lépinay, method of measuring the interior diameter of a barometric tube. Ingenious application of optical laws to deduce internal diameter from the apparent diameter, assuming the refractive index of glass.—G. Quincke, on the measurement of magnetic forces by means of hydrostatic pressure. Abstract of paper in *Philosophical Magazine*, 1884.—W. von Beetz, on normal elements for electromotive measurements. Abstract from *Philosophical Magazine*.—K. Ångström, a new geothermometer. An underground mercury thermometer is read by means of an index attached to a rack and pinion, which is operated from above. When contact is made with the mercury an electric bell rings, and the index is read off.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, February 5.—“The Relation of Bacteria to Asiatic Cholera.” By E. Klein, M.D., F.R.S., Joint Lecturer on General Anatomy and Physiology at the Medical School of St. Bartholomew's Hospital, London.

I propose to bring before the Royal Society the results of an inquiry into the etiology of Asiatic cholera, undertaken, at the instance and expense of the Secretary of State for India, by myself, Dr. Gibbes, and Mr. Alfred Lingard while in India. This investigation will be published *in extenso* by the India Office, but permission has been granted to us to bring to the notice of the Society some of the more important points of our inquiry, particularly those regarding the relation of bacteria to

Asiatic cholera. I shall supplement them by giving the results of further observations which I have made since my return from India.

As is now well known, Dr. Robert Koch, in an extensive inquiry into the etiology of cholera in Egypt, Calcutta, and in France, 1883-84, undertaken by him, Drs. Gaffky and Fisher, at the instance of the German Government, has arrived at certain conclusions, which, briefly stated, are these:

1. In all persons suffering from Asiatic cholera there occur in the rice-water stools during the acute stage of the disease certain well-characterised bacteria, which, on account of their curved shape, Koch called “comma bacilli.”

2. These comma bacilli are mobile rods, of small size, of about the same thickness as tubercle bacilli, but only of half their length; they are always more or less curved, sometimes as much as to form half a circle; they vary in length according to the state of growth; they occur either singly or in couples, in the latter case arranged like an S.

3. The comma bacilli occur in great numbers in mucus flakes as well as in the fluid of the choleraic evacuations. They occur in the lower part of the ileum of persons dead in the acute stage almost to the exclusion of other bacteria, and in such great numbers that the lower part of the ileum may be considered to contain almost “a pure cultivation of comma bacilli.”

4. The mucous membrane of the ileum, particularly that of the lower part, around and in the lymphatic glands located here—the solitary and Peyer's lymph-glands—exhibits in typical and rapidly fatal cases characteristic alterations: loosening and detachment of the epithelium of the surface and of that lining the glands of Lieberkühn; swelling and congestion of the blood-vessels of the mucous membrane, particularly at the peripheral portions of the lymph glands. These alterations are due to the presence, growth, and multiplication of the comma bacilli in these tissues, and the disease cholera is caused by the production on the part of these comma bacilli, and by the absorption on the part of the system of a special chemical ferment.

This state of the presence of the comma bacilli in the tissue is best pronounced in the lower part of ileum; higher up it is more limited, and gradually diminishes, and finally disappears in the upper part of the small intestine.

5. The blood and other tissues are free of any organisms.

6. The comma bacilli grow well outside the body at the ordinary temperature of the room, but better still at higher temperatures up to 38° or 40° C. They divide transversely; after division the two offsprings may remain joined end to end with shape of an S, and by further division they may grow into a spiral-like or wavy form. They grow well in the mucus flakes taken from the intestine, and placed on linen kept in a moist cell; they grow well on potato, in broth, in Agar-Agar jelly, in solid nourishing gelatine mixtures (gelatine, peptone, and beef extract). In this latter substance they exhibit a peculiar and definite mode of growth not seen by Koch on any other bacteria. The comma bacilli require for their growth an alkaline medium; they are killed by acid, by drying, and various antiseptic media.

7. On account of their constant occurrence in the intestines of patients suffering from Asiatic cholera, on account of their absence in all other diseases of the intestine, and on account of their peculiar mode of growth in nourishing gelatine, Koch vindicates for these comma bacilli not only an important diagnostic value, but also considers them as the true cause of cholera.

8. Since his return to Germany, Koch has convinced himself of the correctness of the observations of Nicati and Rietsch, who maintain that cholera can be produced in dogs and guinea-pigs by injecting directly into the small intestine of these animals the comma bacilli taken either directly from the choleraic evacuations, or from artificial cultivations.

Our investigations enable us to say this:

1. Koch's statement as to the constant occurrence of comma bacilli in the rice-water stools of cholera patients is correct; the comma bacilli vary greatly in numbers in different stools and in different cases, in some being exceeding scarce, in others numerous.

2. These comma bacilli vary greatly in length, some being twice and three times as long as others, some well curved as much as to form half a circle, others showing only just a slight bend. The name “comma bacillus” is inappropriate, as in reality they are vibrios.

3. The comma bacilli occur in the mucus flakes of the rice water stools as well as in those taken from the ileum of a person

dead of cholera. The sooner after death the examination is made, the fewer comma bacilli are found in the mucus flakes; even in typical rapidly fatal cases the mucus flakes taken from ileum and examined soon after death (from between fourteen minutes and an hour or an hour and a half) contain the comma bacilli only very sparingly indeed, and not to the exclusion of other bacteria. Our investigations do not bear out Koch's statement as to the lower part of the ileum being in acute typical cases of cholera almost "a pure cultivation of comma bacilli." In not one of the many post-mortem examinations of typical acute cases have we found such a state.

4. The mucous membrane of the ileum of typical rapidly fatal cases, if examined soon after death, does not contain in any part any trace of a comma bacillus or any other bacteria, not even in the superficial loosened epithelium.

If the post-mortem examination is sufficiently delayed, comma bacilli and other bacteria may be found penetrating into the spaces of the mucous membrane.

The theory of Koch's as to the comma bacilli present in the mucous membrane secreting a chemical poison inducing the disease cannot, therefore, be correct.

5. Neither the blood nor any other tissue contains comma bacilli or any other micro-organisms of known character.

6. The behaviour of the comma bacilli in artificial media is not such as to justify their being considered as specific. They grow well in alkaline and neutral media, are not killed by acids, and their mode of growth in gelatine mixtures is not more peculiar than that of other putrefactive bacteria; they show marked differences when grown in different media, but not more so than the ordinary putrefactive bacteria when compared in their growth with one another.

7. Koch overlooked that "comma bacilli" occur in other intestinal diseases, in the mouths of healthy persons, and, as shown recently, even in some common articles of food.

8. The experiments performed by Koch and others on animals do not in the least prove that the comma bacilli are capable of producing cholera or any other disease. The results obtained by them are much easier explained in a manner opposed to that given by Koch and others.

9. There is direct evidence to show that the water contaminated with choleraic evacuations, and containing, of course, the comma bacilli, when used for domestic purposes, including drinking, by a large number of persons, did not produce cholera.

10. The mucus flakes taken from the small intestine of a typical rapidly fatal case of cholera contain numerous mucus corpuscles filled with peculiar minute straight bacilli; in this state they are found when the examination is made very soon after death; soon, however, the mucus corpuscles swell up and disintegrate, and then their bacilli become free.

The small bacilli are never missed in the mucus flakes. They are only one-third or one-fourth the length of the comma bacilli, and about half their thickness. They are non-mobile; they grow well in Agar-Agar jelly, but show in their modes of growth no peculiarity by which they could be considered as specific. When grown on the free surface of the nourishing material they form spores.

11. These small bacilli are not present in the blood, in the mucous membrane of the intestine, or in any other tissue.

12. Experiments made with these small bacilli on animals produced no result.

13. Since my return to London I have ascertained that the comma bacilli of cholera show two distinct modes of division, the one known one of transverse division, and a second one of division in length. When growing in Agar-Agar jelly at the ordinary temperature of the room, after some days the bacilli swell up owing to the appearance in their protoplasm of one or more vacuoles; as these vacuoles increase, so the comma bacilli become gradually changed first into plano-convex, then into oblong bi-convex, and ultimately into circular corpuscles. The longer the original comma bacillus, the larger the final circle. These circular organisms are mobile just as the comma bacilli, and by disintegration of the protoplasm at two opposite points two perfect more or less semicircular comma bacilli are formed. Growing the comma bacilli in Agar-Agar jelly kept at higher temperatures (30-40° C.), the comma bacilli multiply by transverse division only, but transferring these to Agar-Agar jelly and keeping this at the ordinary temperature of the room, they again gradually change into circular organisms, which, by division in the diameter of the circle, form two new comma bacilli.

Linnean Society, February 5.—Mr. Frank Crisp, LL.B., Vice-President and Treasurer, in the chair.—Mr. John Hodgkin was elected a Fellow of the Society.—A paper was read "On the Arbaciadæ, Gray. Part I, the Morphology of the Test in the genera *Calopleurus* and *Arbacia*," by Prof. P. Martin Duncan and W. Percy Sladen. The species of recent and fossil *Calopleurus* and the recent forms of *Arbacia* examined present some structural details of both primary and secondary classificatory importance, which have hitherto been neglected and not recorded. The ambulacral plates differ from those of all other Echinoidea in the arrangement of the triplets, there being a central primary plate with an adoral and an aboral demi-plate. It is shown that there are no additional plates near the peristome in the species of *Arbacia*. The structure of the sutures, especially of the median inter-radials, is a modification of the dwelling which has been described in *Tennopleurus* by one of the authors. The double-optic pore noticed by Lovén occurs in the fossil species of *Calopleurus*, and in *C. Maillardi*, a recent species. The authors compare the different forms, and exclude *Arbacia nigra* from the genus *Arbacia*. The next part will deal with the classification.—Then followed a paper on Burmese Desmids, by Mr. W. Joshua. The specimens were forwarded by Dr. Romanis, F.L.S., of Rangoon, and got chiefly from the leaves of *Pistia stratiotes* in a tank some twenty-six miles from the mouth of the River Irrawaddy. Of 186 species in sixteen genera hitherto observed, 100 have their representatives in Europe. Altogether some forty supposed new species are described by the author, besides several new varieties and a list of others previously recorded is given.—Mr. W. F. Kirby read a paper on the employment of the names proposed for genera of Orthoptera previously to 1840. In this communication the author shows the application of every name proposed from the time of Linne to the publication of Serville's "Hi toire naturelle des Insectes Orthoptères," and there is appended a full bibliography of the subject.

Zoological Society, February 3.—Prof. W. H. Flower, LL.D., F.R.S., President, in the chair.—The Secretary exhibited a specimen of a rare South American Lizard (*Heterodactylus imbricatus*), presented to the Society by Mr. G. Lennon Hunt; and a specimen of a rare Beetle, of the family Buprestidae, from Beloochistan (*Fulodis finchi*).—A letter was read from Dr. George Bennett, F.Z.S., of Sydney, containing remarks on the Tree-Kangaroo of Queensland (*Dendrolagus humboldti*), lately described in the Society's *Proceedings*.—A series of specimens of Lepidopterous insects, which had been bred in the insect-house in the Society's Gardens during the past season, was laid on the table.—A communication was read from M. Taczanowski and Count Berlepsch, containing an account of the third collection of birds obtained by M. Stolzmann in Ecuador. The collection contained examples of 289 species, of which ten were new to science.—Lieut.-Col. C. Swinhoe read the first of a series of papers on the Lepidoptera of Bombay and the Decan. The present communication contained an account of the Rhopalocera, and gave the results of two years' daily collecting.—A communication was read from Mr. Robt. Collett, C.M.Z.S., giving an account of *Echidna acanthion*, a new species of Spiny Ant-eater lately discovered in Northern Queensland.—A communication was read from Mr. Jean Stolzmann, containing the description of a new Rodent, belonging to the genus *Calogenys*, from Ecuador, proposed to be called *Calogenys taczanowskii*.

PARIS

Academy of Sciences, February 2.—M. Bouley, President, in the chair.—The death of M. Dupuy de Lôme, member of the Section for Geography and Navigation, who died on February 1, was announced by the Secretary.—On the mechanical principles determining the rotation of surfaces on a fixed surface, by M. H. Resal.—Remarks on the cultivation of the phylloxera in tubes, in reply to M. Balbiani's objections to the present practice of destroying the winter eggs of this parasite, by M. P. de Lafitte.—On a plane representation of certain dynamic problems respecting the displacements of a figure of invariable form subjected to four conditions, by M. A. Mannheim.—Description of a selenium actinometer designed for the purpose of measuring the relative intensity of the luminous solar rays at various elevations above the horizon, by M. H. Morize.—On a new preparation of the trifluoride of phosphorus, and on the analysis of this gas, by M. H. Moissan.—Analysis of the green ferrocyanides or glaucocyanides, by MM. A. Etard

and G. Bémont.—On vincetoxine, by M. Ch. Tauret. This term, "vincetoxine" (from Vincetoxicum, the common name of the Asclepias), is applied by the author to a new glucoside, to which is due the remarkable property possessed by the aqueous solution of the hydro-alcoholic extract of the Asclepias root of clouding when the temperature is raised, and becoming limpid when lowered. Vincetoxine has the same centesimal composition as glycyrrhizine, $C_{48}H_{36}O_{18}$.—On the signification of the polarimetric experiments executed with the solution of cotton in the ammoniacal reagent; polarimetric researches on this reagent, by M. A. Béchamp.—On a particular case of catalytic action.—On the composition of the ashes of the Equisetaceæ; its application to the formation of coal, by M. Dieulafoy. The author finds that the Equisetaceæ and other typical plants of the Carboniferous epoch contain a much larger proportion of sulphuric acid than those of the present epoch. In this fact we have the natural explanation of the large quantities of sulphur and of sulphate of lime present in all kinds of coal. The sulphur and sulphate entered into the original composition of those plants to whose decomposition are due the carboniferous formations.—On the various cetaceans cast up on the French seaboard during recent years, by M. Georges Pouchet.—Note on the influence of sudden barometric pressure on earthquakes and volcanic activity, by M. F. Laur. Arguing from the fire-damp explosions in mines and other analogous phenomena, the author concludes that all underground disturbances are due to abrupt atmospheric changes communicated even through the medium of the ocean to the crust of the earth. Volcanic eruptions are relatively superficial phenomena due to the expansion of the internal gases when a rupture of equilibrium takes place. Hence they are all the more violent the nearer they are to the surface, and the more closely connected with previously existing terrestrial vacuums.

BERLIN

Physical Society, January 23.—Dr. Kayser laid before the Society a photograph of lightning taken in France and probably under the same minimal atmospheric pressure as that under which he had himself taken his recently-published photograph, the lightnings in France having been photographed three days earlier than those in Berlin. On the small gelatinous membrane sent to Dr. Kayser, still better than on that, on an enlargement of the original prepared by the speaker, there was presented very beautifully to view the extraordinarily manifold ramifications of the lightning. From the lowest part of a dark cloud a broad flash of light was seen to dart forth and throw off many fine branches, which again united multifariously, the junction at one place between one branch and another showing a broader line, while at other places the flashes appeared double.—Dr. Lummer spoke on the interference phenomena produced by two plain parallel glass plates. He briefly adduced the experimental results, already published by him, of an investigation of his own, according to which, at small angles of the glass plates, namely, up to as far as 60° , the interference phenomena represented a circle passing, with increasing angles, into an ellipse, the axis of which at 90° were as 1:2, until, on still further enlargement of the angle, the ellipse became transformed into a straight line, which soon in turn, and till the angle of the plates approximated to 180° , changed into a hyperbola. The speaker developed at large the theory of the phenomenon, and deduced the formulæ, which, on inserting the numerical data, were found to coincide remarkably with the experimental results.—A communication from Dr. Müller-Erbach, designed for the *Verhandlungen*, had been given in and was read. Dr. Müller had sought to determine the sphere of action of the molecular forces by the thickness of the layers arising from the adhesion on solid surfaces of gases and vapours. He chose for his experiments pulverised oxide of iron and carbon disulphide. The latter became, at first very strongly, and then with abating intensity, condensed by the oxide. After four days the quantity of carbon disulphide absorbed in twenty-four hours had sunk to less than 1 mg., without, however, entirely disappearing. By microscopic measurements of the grains of oxide of iron, the author approximately calculated the magnitude of the absorbing surface, and from the quantity of the absorbed carburet of sulphur the thickness of the layer of vapour held fast by adhesion. From the circumstance that the absorption of the vapour very rapidly diminished and after a few days became quite inconsiderable, Dr. Müller-Erbach concluded that it was not the quantities of vapour at first condensed which drew in those later absorbed, but that the

whole absorbed layer of vapour got to be held fast through adhesion by the surface of the iron, and in this way he arrived at values bearing on the sphere of action of molecular forces which far surpassed all that had been hitherto obtained.—Finally, Prof. Neesen directed attention to the disadvantage of having but one term for two different meanings, such, for example, as the word "Gewicht" (gravity, weight), which was employed to signify both a force and a mass, a confusion which often led to inconveniences. Scientifically either the force or the mass should be called Gewicht, the other being denominated by another name. The debate which this question gave rise to was to be continued at a future sitting.

VIENNA

Imperial Academy of Sciences, January 8.—On the fossil flora of Sagor (Carniola), by C. von Ettingshausen.—On pendulum experiments, by P. Czermak and R. Hiecke.—On a new construction of electromagnets for dynamo-machines (sealed packet), by A. von Waltenhofen.

January 15.—On the difference between crystalline and other anisotropic substances, by V. von Ebner.—On a new system of cable-telegraphy for long cable-lines, called the differential recorder (sealed packet), by E. von Taund-Szyl.—On a new method for determining manganese in specular iron ore, ferromanganates, and in the most important ores, by W. Kalmann and A. Smolka.

STOCKHOLM

Society of Natural Sciences, November 15, 1884.—The President, M. Wörn, in the chair.—Prof. Lecke gave an account of a certain fish larvæ which he had studied during a sojourn at Messina. At times the sea was so full of animals, that a vessel immersed in the same would contain as much of the latter as water. He further exhibited a number of rare fish from the Mediterranean, comprising *Trachypterus*, *Pe'oria*, and *Krohnus*.—Dr. Lindberg explained the working of the Siemens apparatus for registering the quantity and alcoholic contents of spirits. They are now compulsory in all Swedish distilleries, and work very satisfactorily.

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